FIG. 1

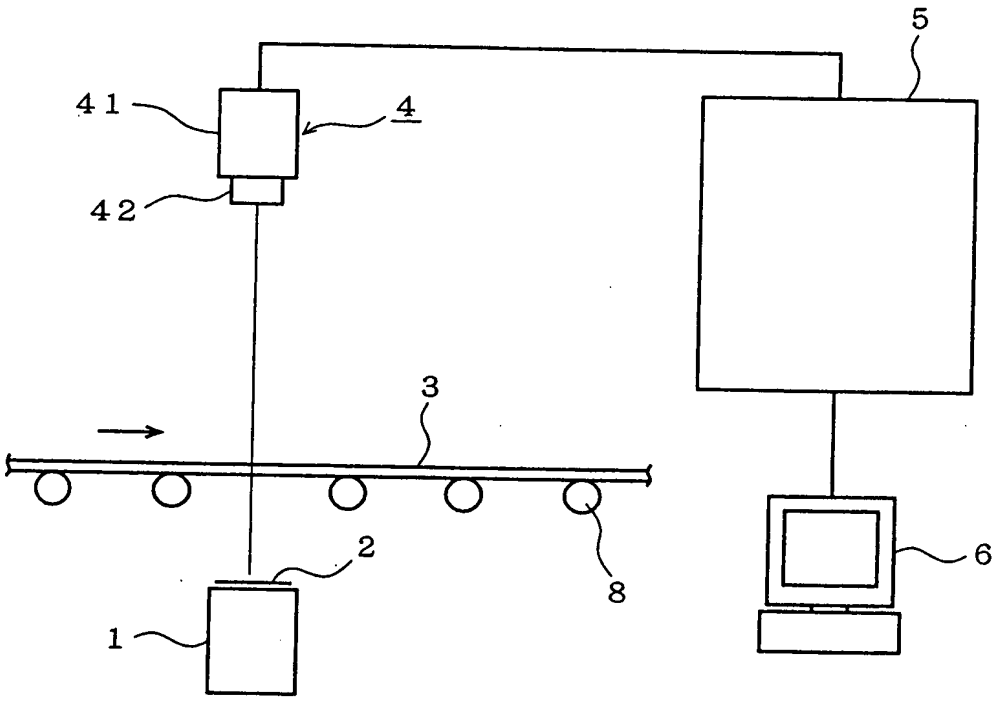


FIG. 2

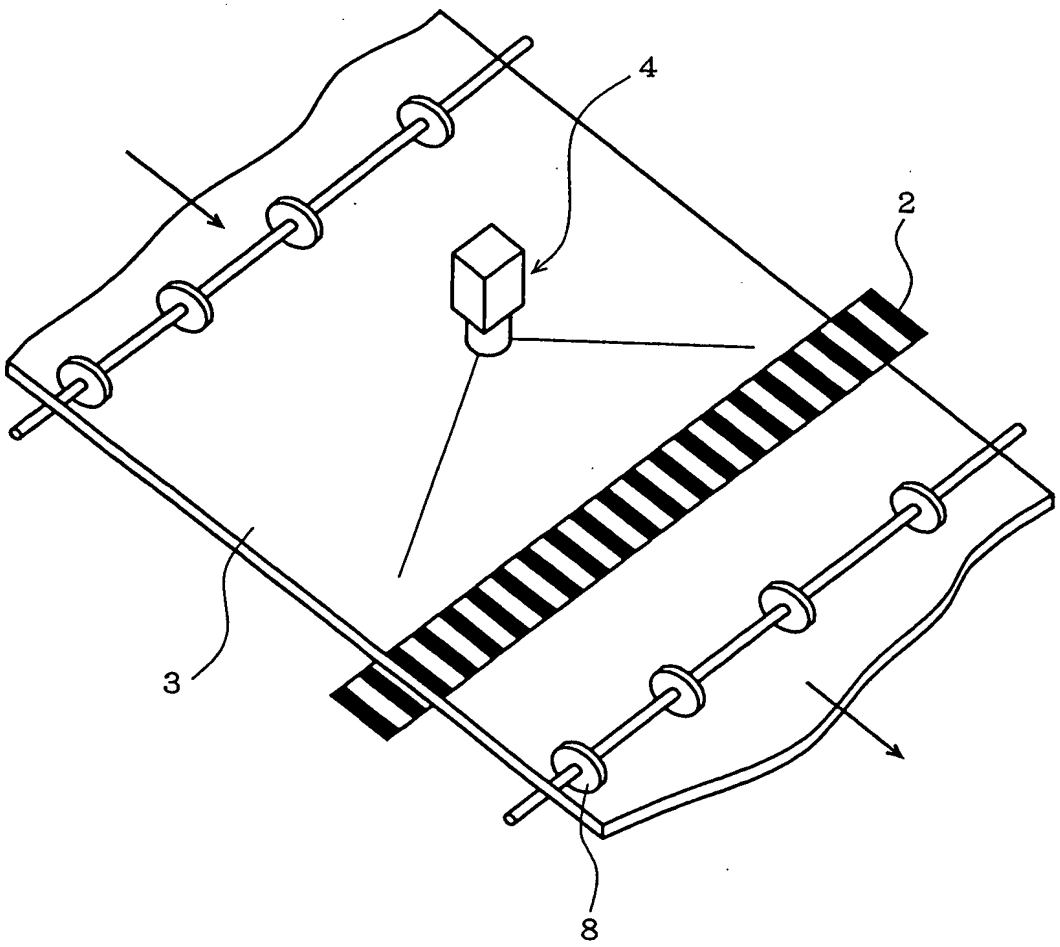


FIG. 3

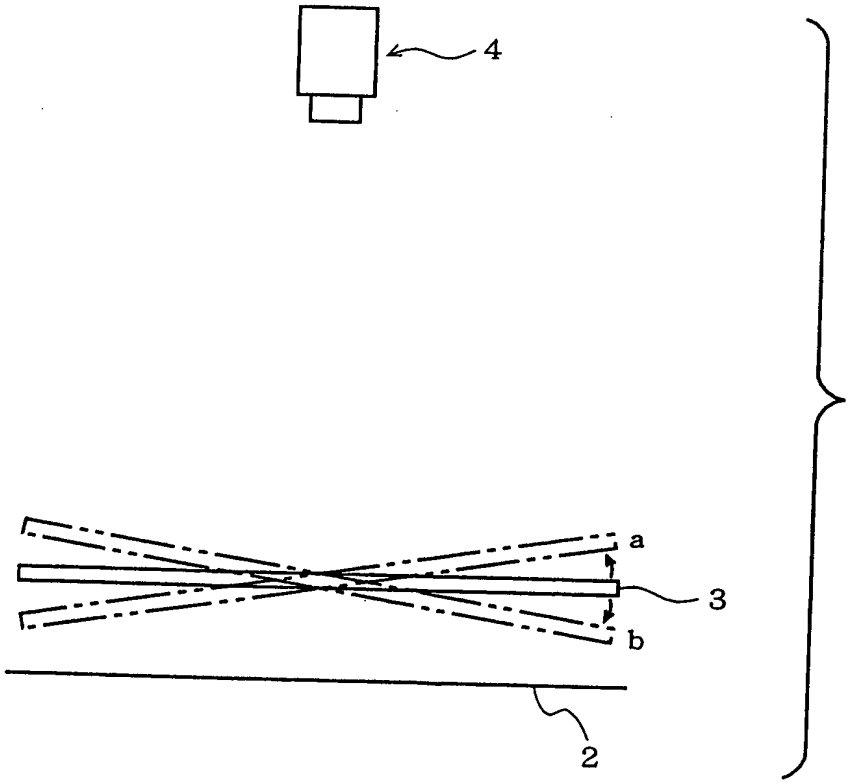


FIG. 4

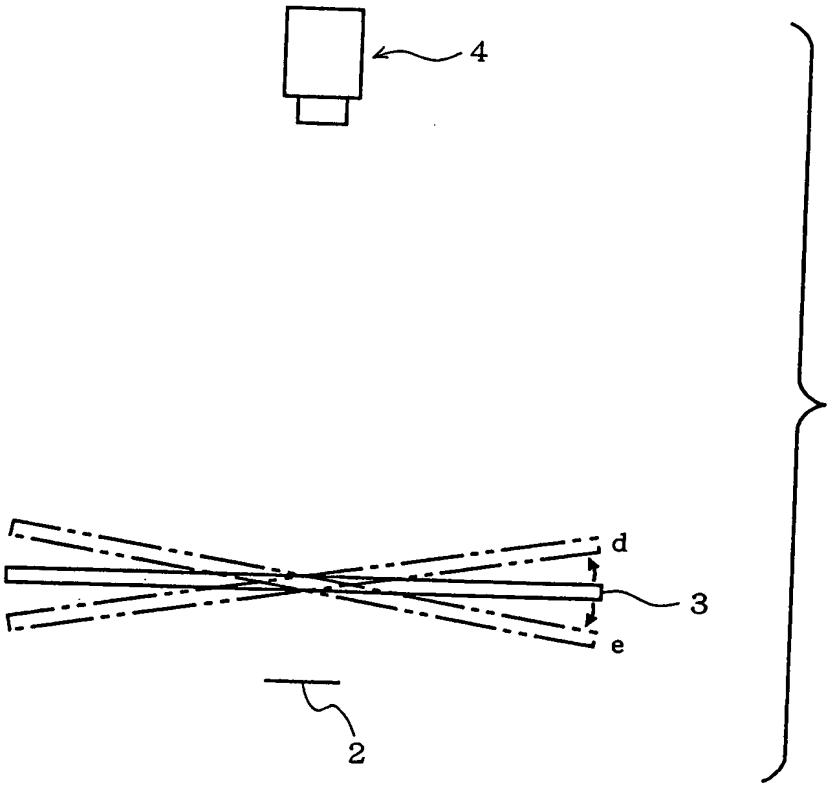


FIG. 5

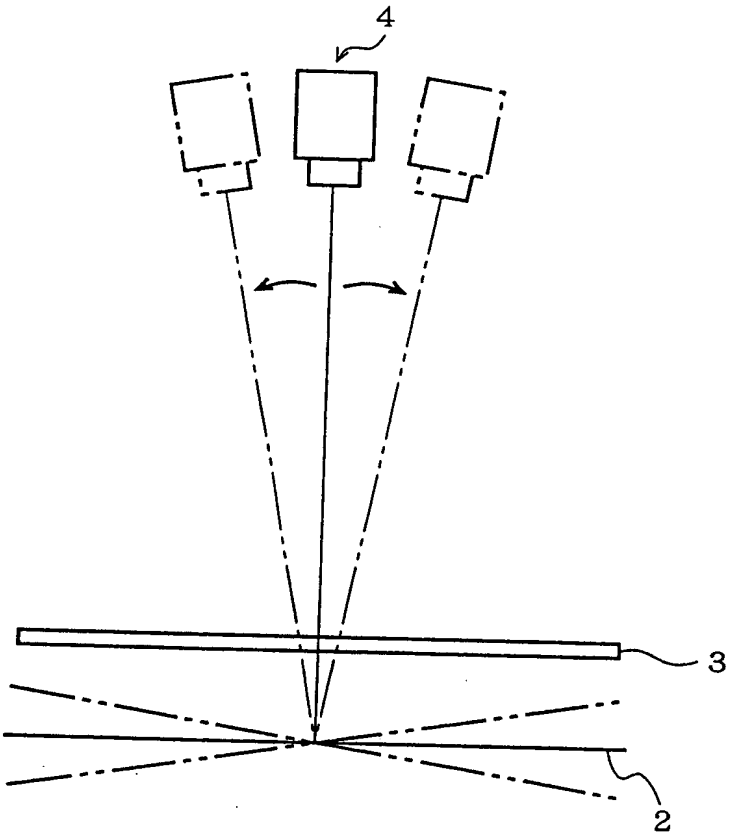


FIG. 6

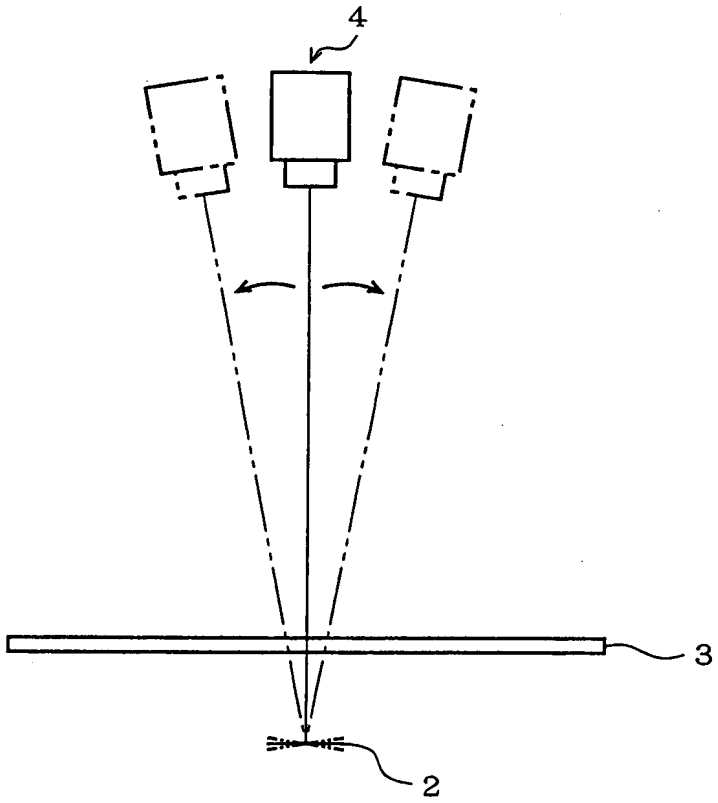


FIG. 7A

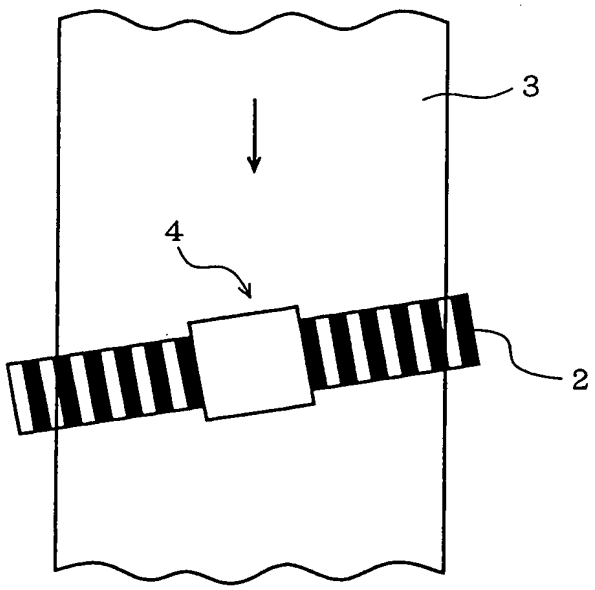


FIG. 7B

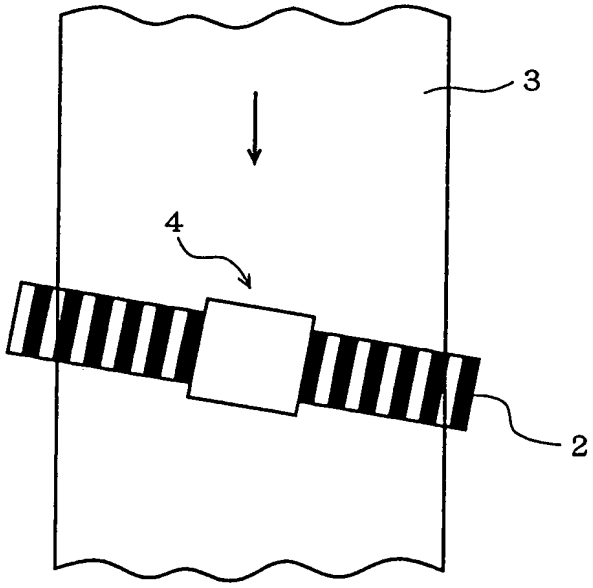


FIG. 8

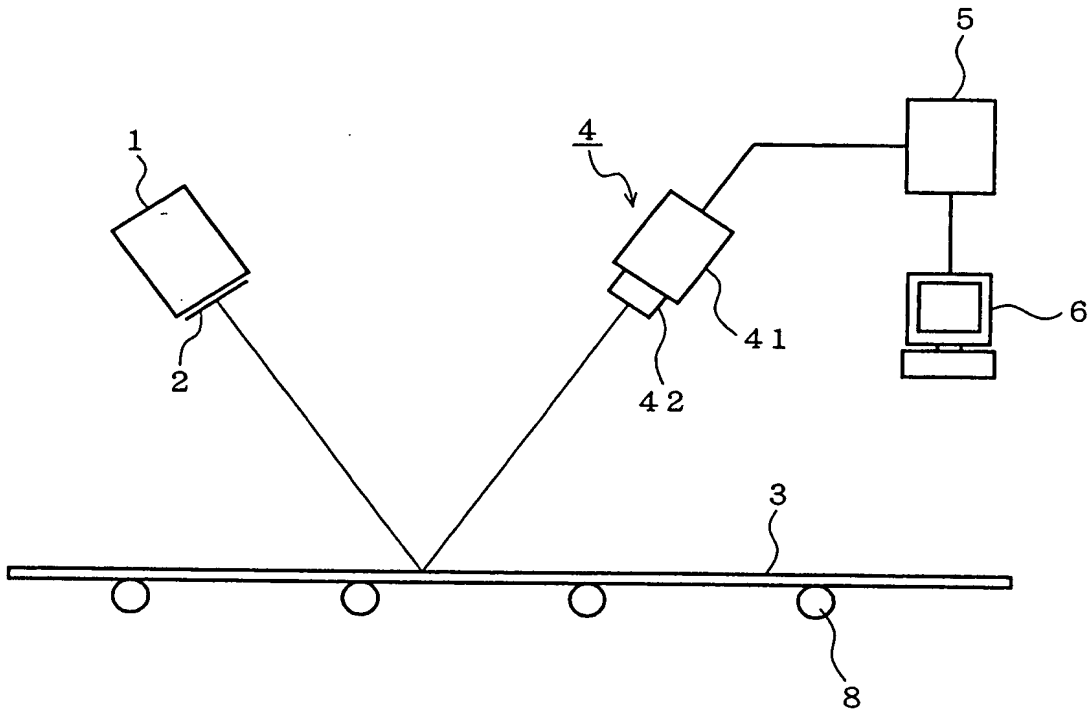


FIG. 9

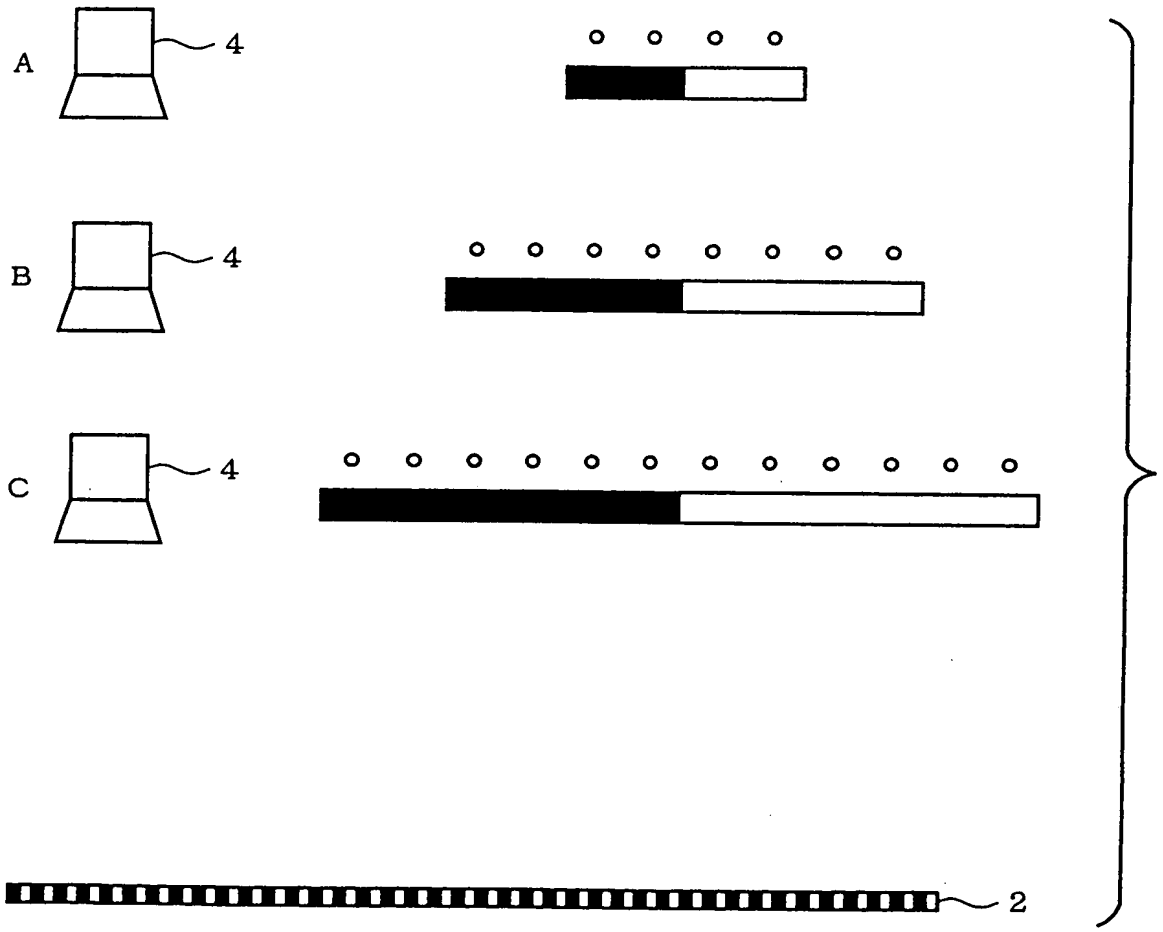


FIG. 10A

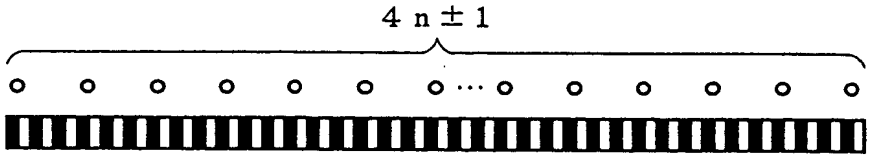


FIG. 10B

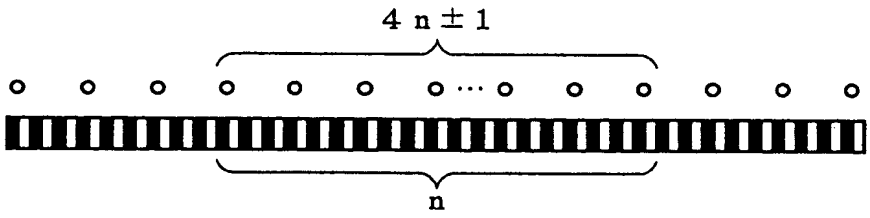


FIG. 10C

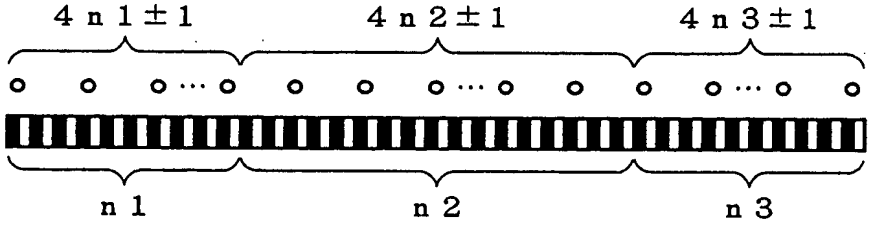


FIG. 11

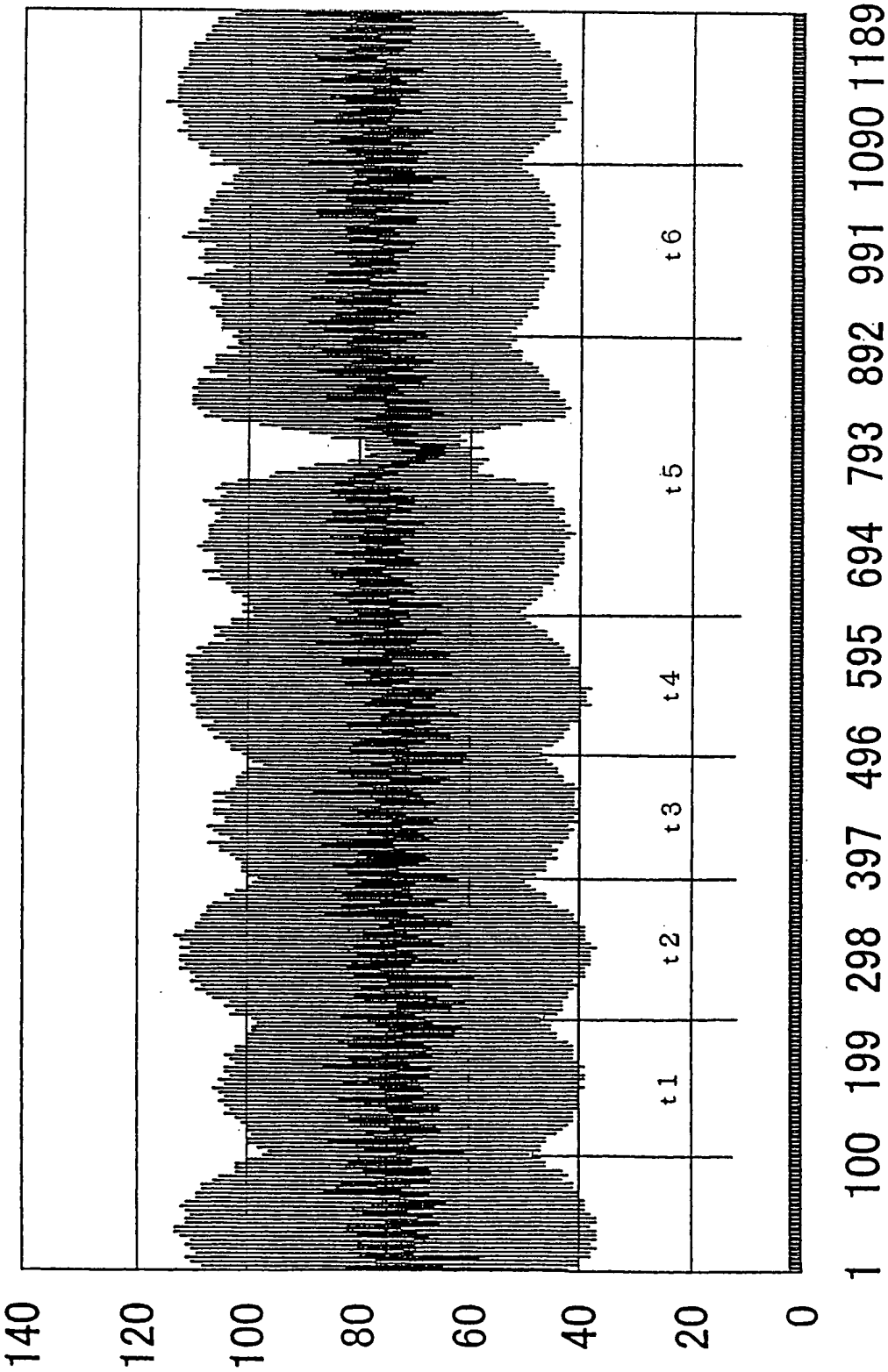

140
120
100
80
60
40
20
0
1
100
199
298
397
496
595
694
793
892
991
1090
1189
t1
t2
t3
t4
t5
t6

FIG. 12

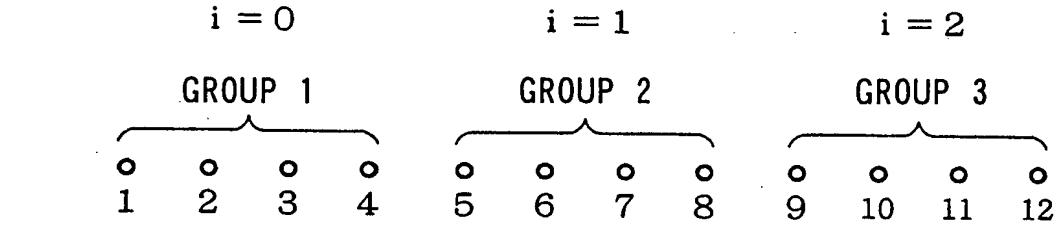


FIG. 13

	C_{4i+1}	C_{4i+2}	C_{4i+3}	C_{4i+4}
FOR WAVE A	+	+	−	−
FOR WAVE B	+	−	−	+
FOR WAVE A	−	+	+	−
FOR WAVE B	+	+	−	−

FIG. 14

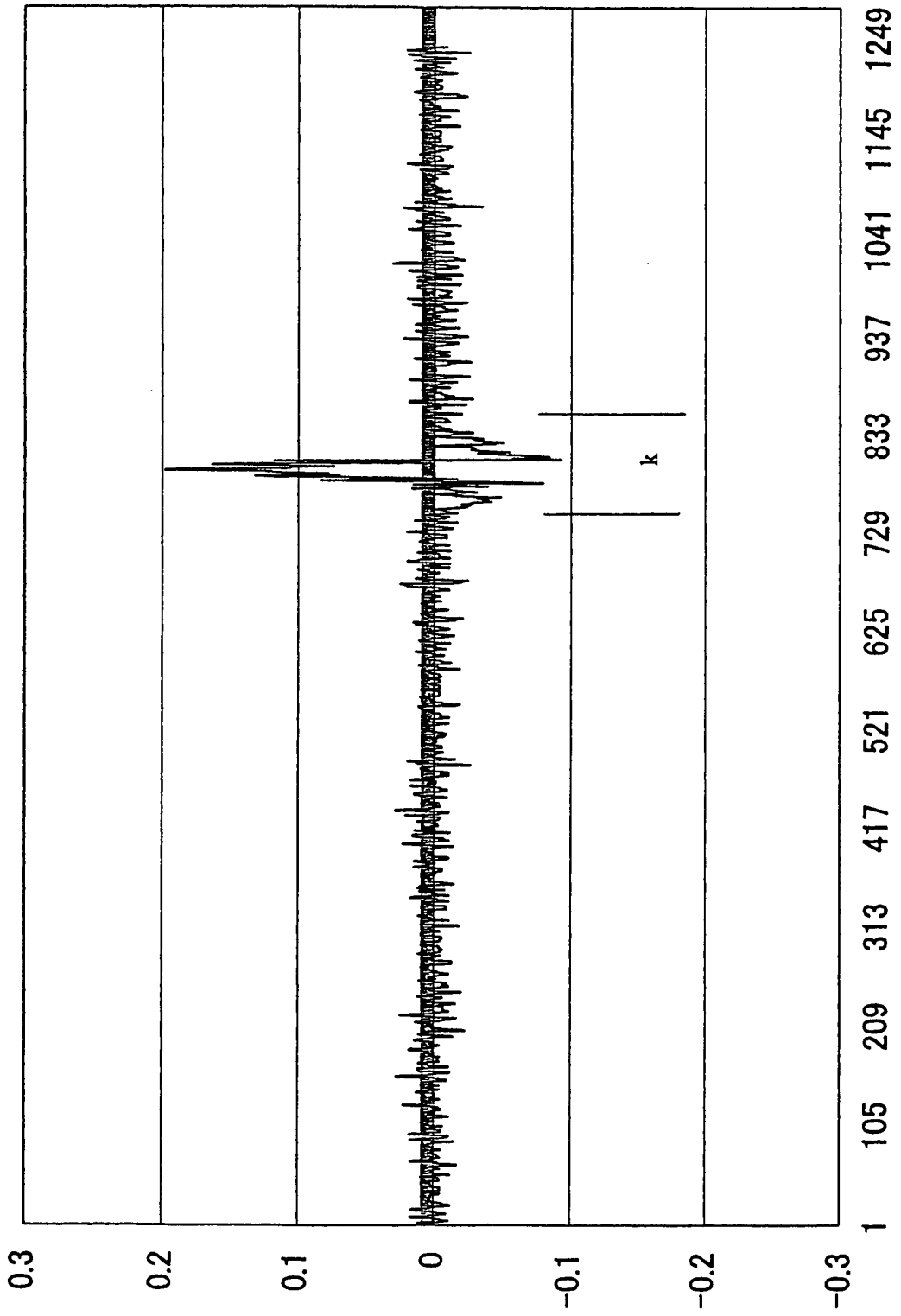

0.3
0.2
0.1
0
-0.1
-0.2
-0.3
1
105
209
313
417
521
625
729
833
937
1041
1145
1249
k

FIG. 15

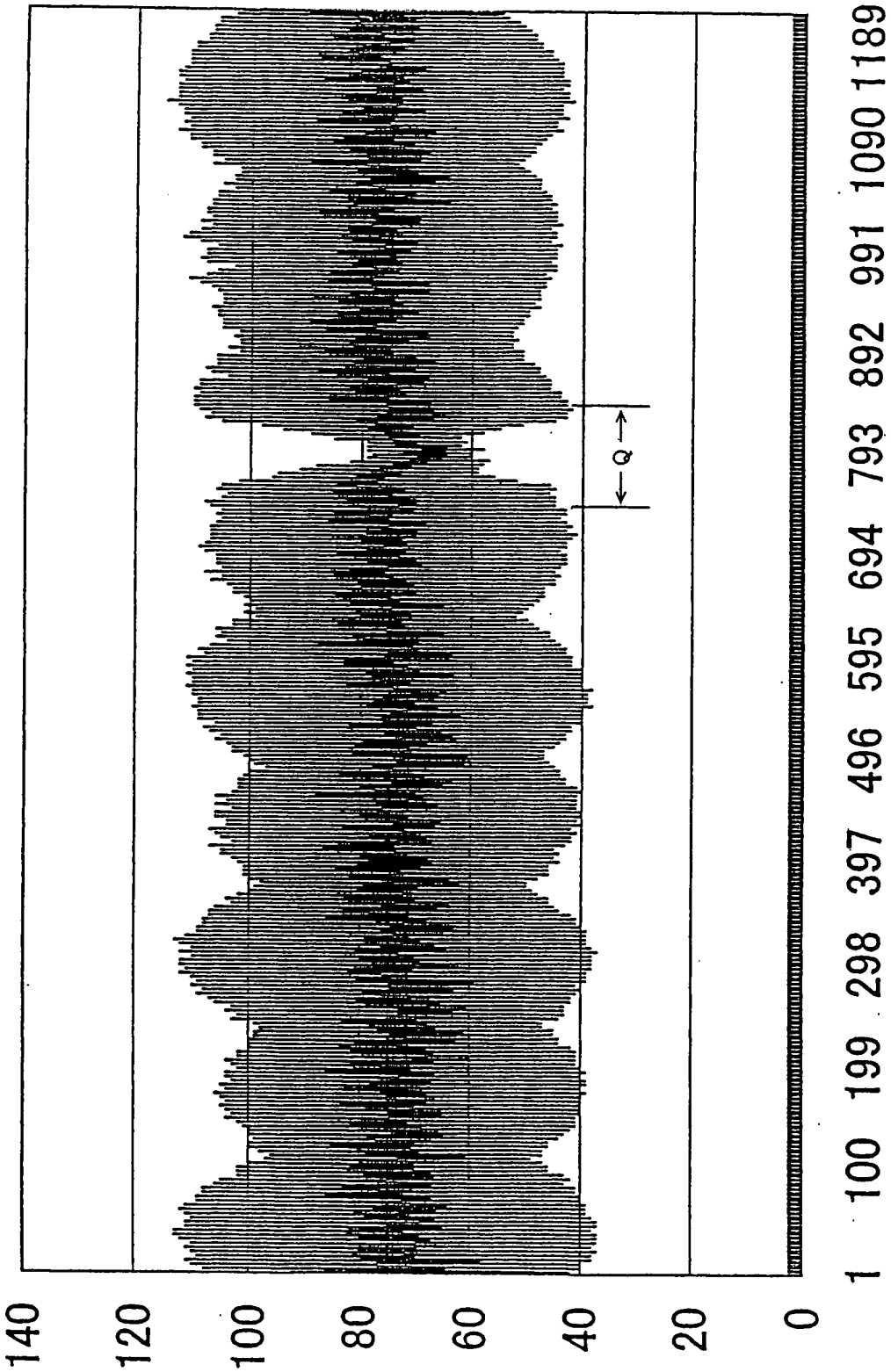

140
120
100
80
60
40
20
0
1
100
199
298
397
496
595
694
793
892
991
1090
1189
Q

FIG. 16

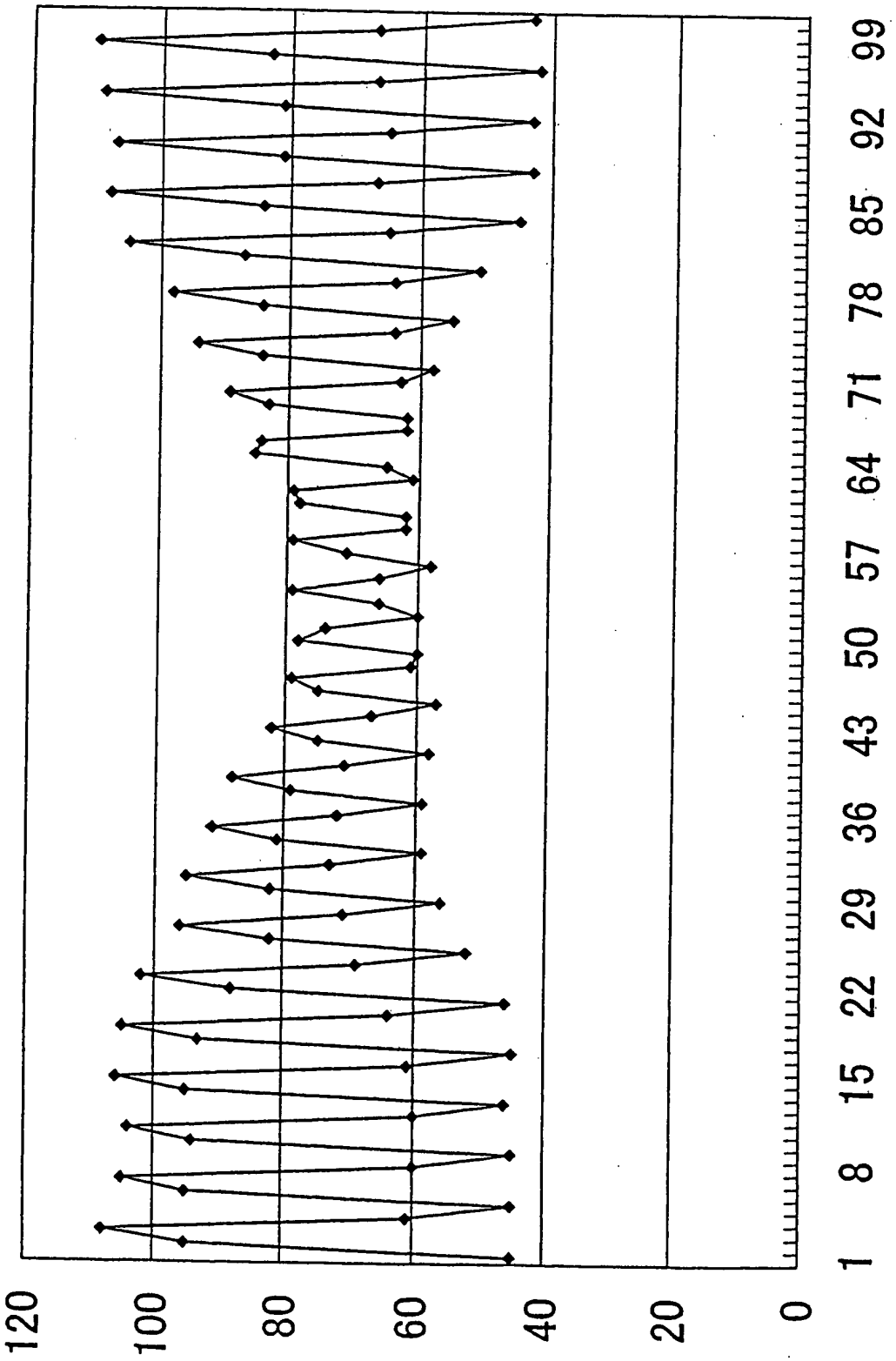


FIG. 17

FLOWCHART OF SOFTWARE PROCESSING

h : NUMBER OF PIXELS PER PITCH
fugo : SIGN FOR CALCULATING ORIGINAL IMAGE DATA
shift : AMOUNT OF SHIFT FOR CALCULATION FOR GENERATING SINE WAVES SHIFTED AT 90°
data : ORIGINAL IMAGE DATA
aaa : DATA ON SINE WAVES WITH PHASE A
bbb : DATA ON SINE WAVES WITH PHASE B
ccc : PHASE ANGLE ON LISSAJOUS FIGURE
ddd : ANGULAR SPEED
pixel : NUMBER OF PIXELS FOR PROCESSING

STEP 1
GENERATE SIGN
GENERATE ++++----++++----++++----

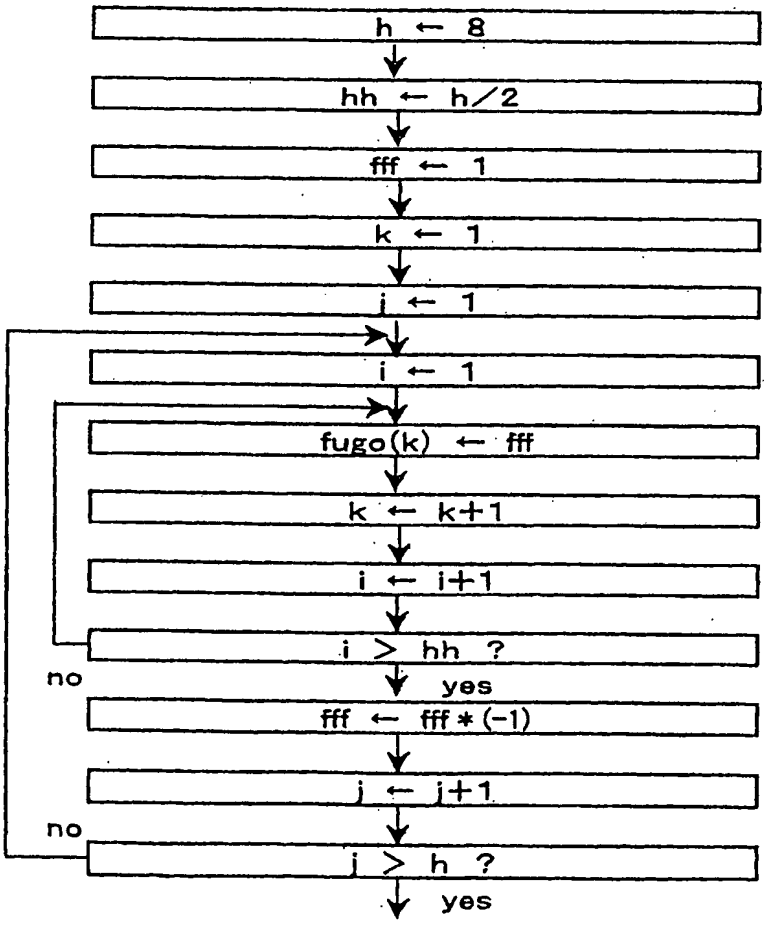


FIG. 18

STEP 2 GENERATE SINE WAVES WITH PHASE A AND PHASE B

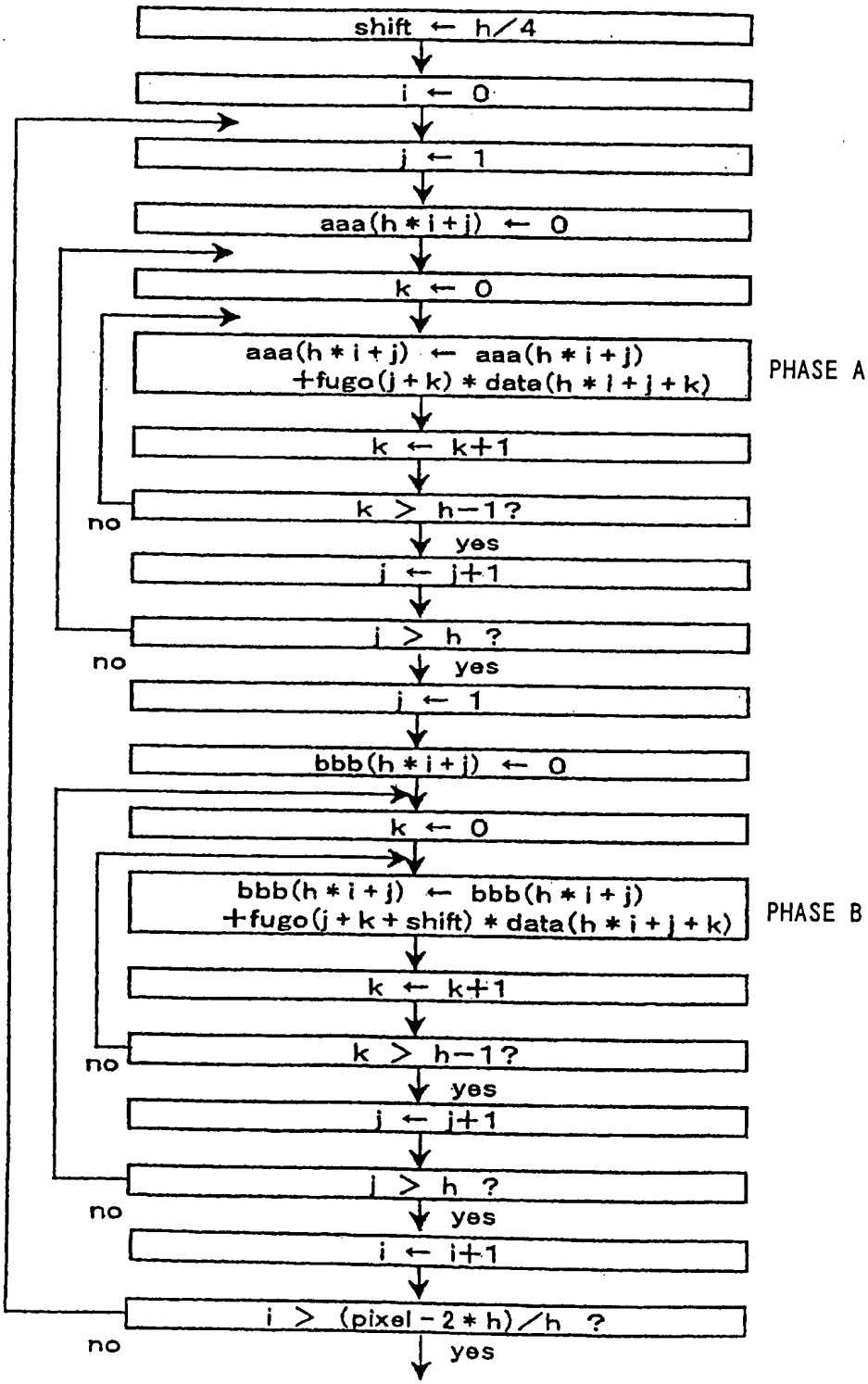


FIG. 19

STEP 3 CALCULATE PHASE ANGLE AND ANGULAR SPEED

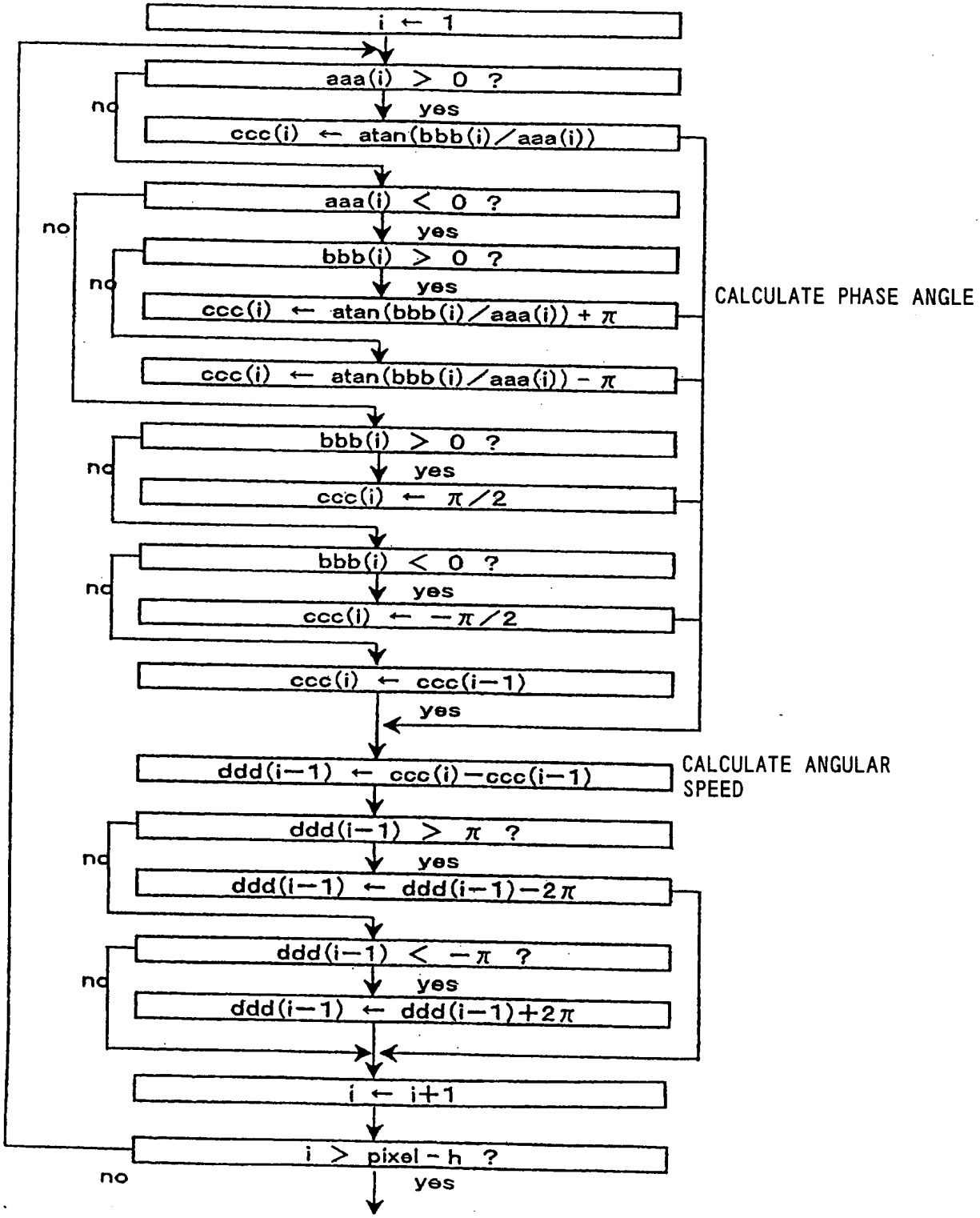


FIG. 20

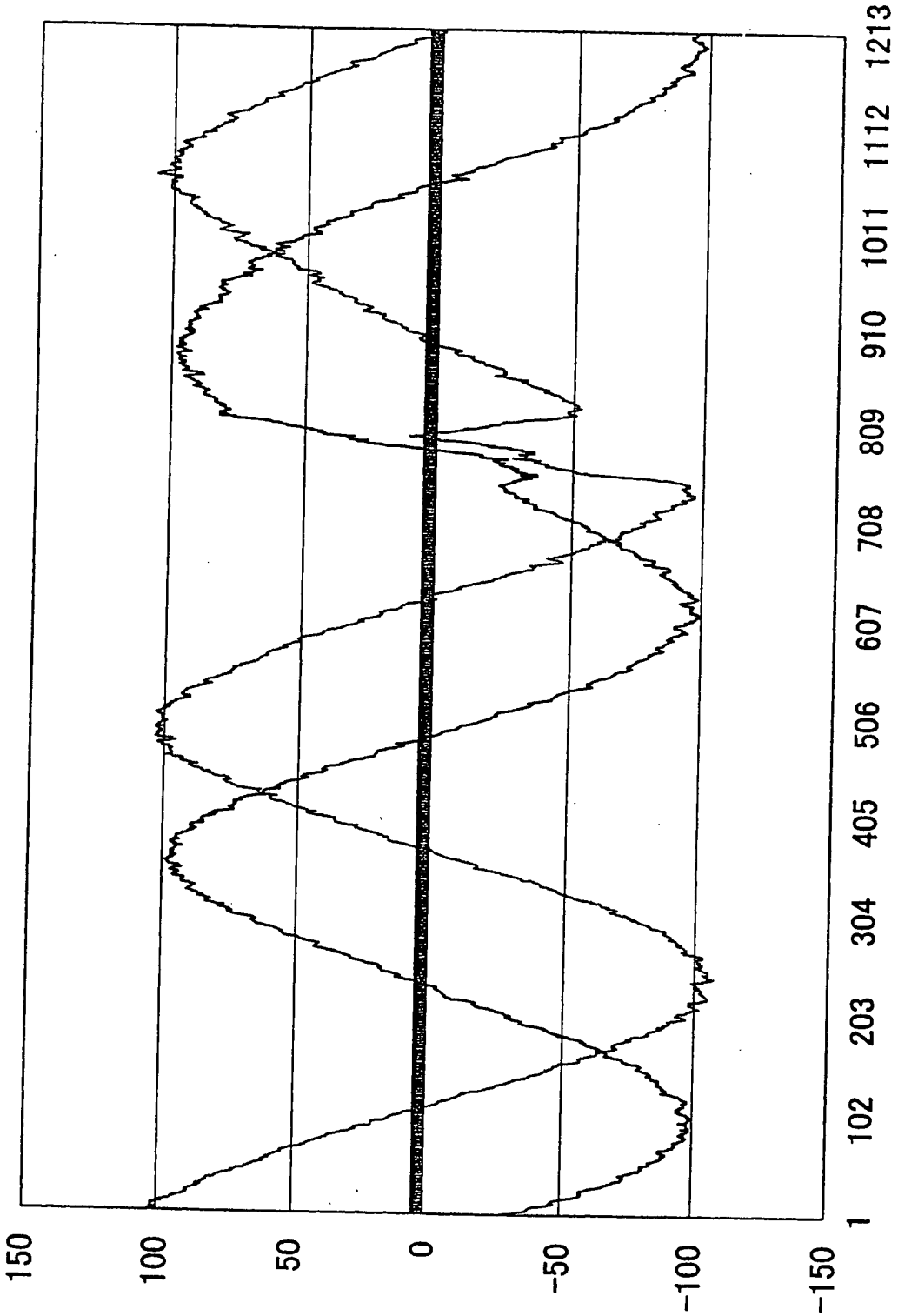

150
100
50
0
-50
-100
-150
1
102
203
304
405
506
607
708
809
910
1011
1112
1213

FIG. 21

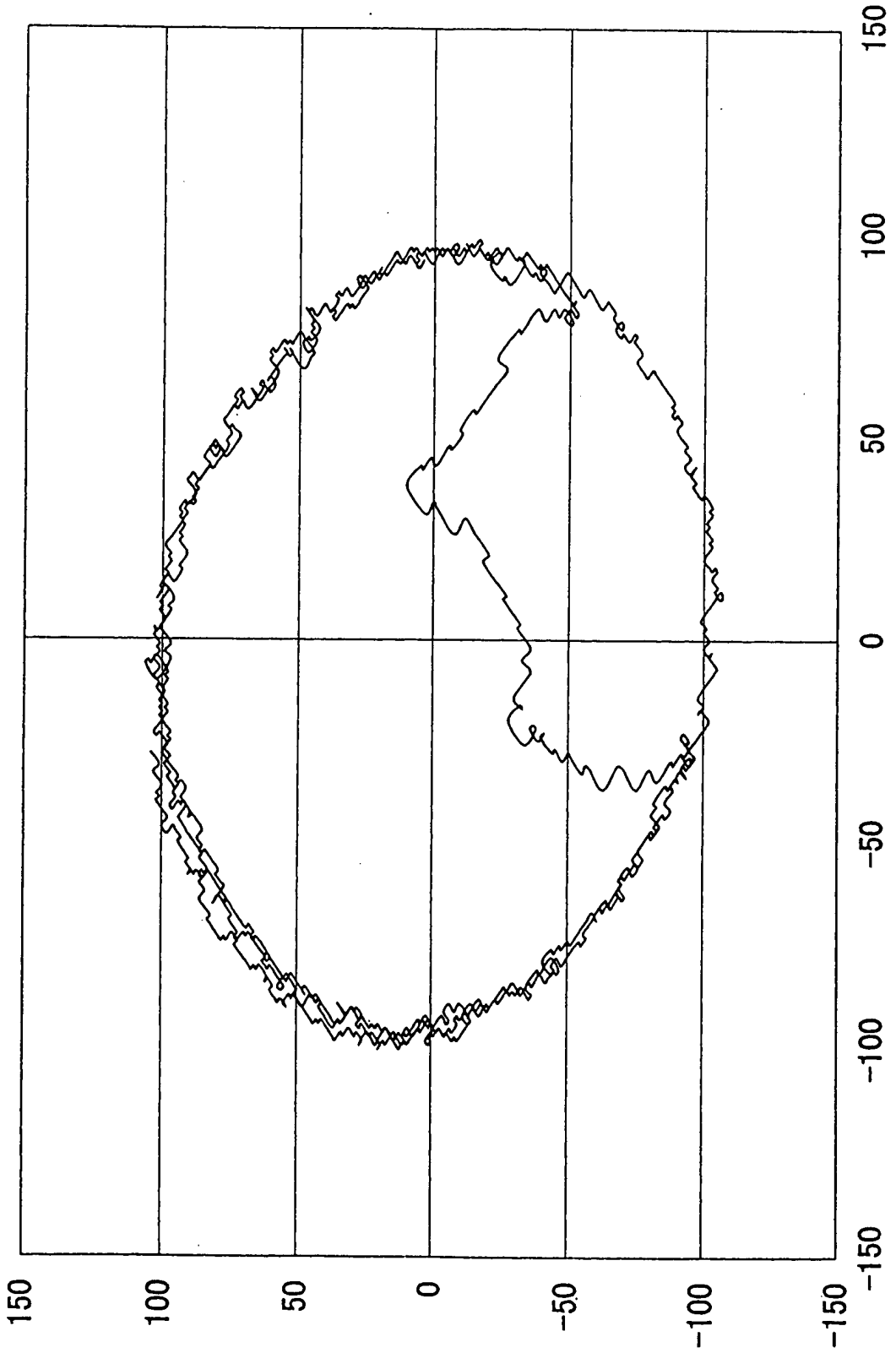


FIG. 22

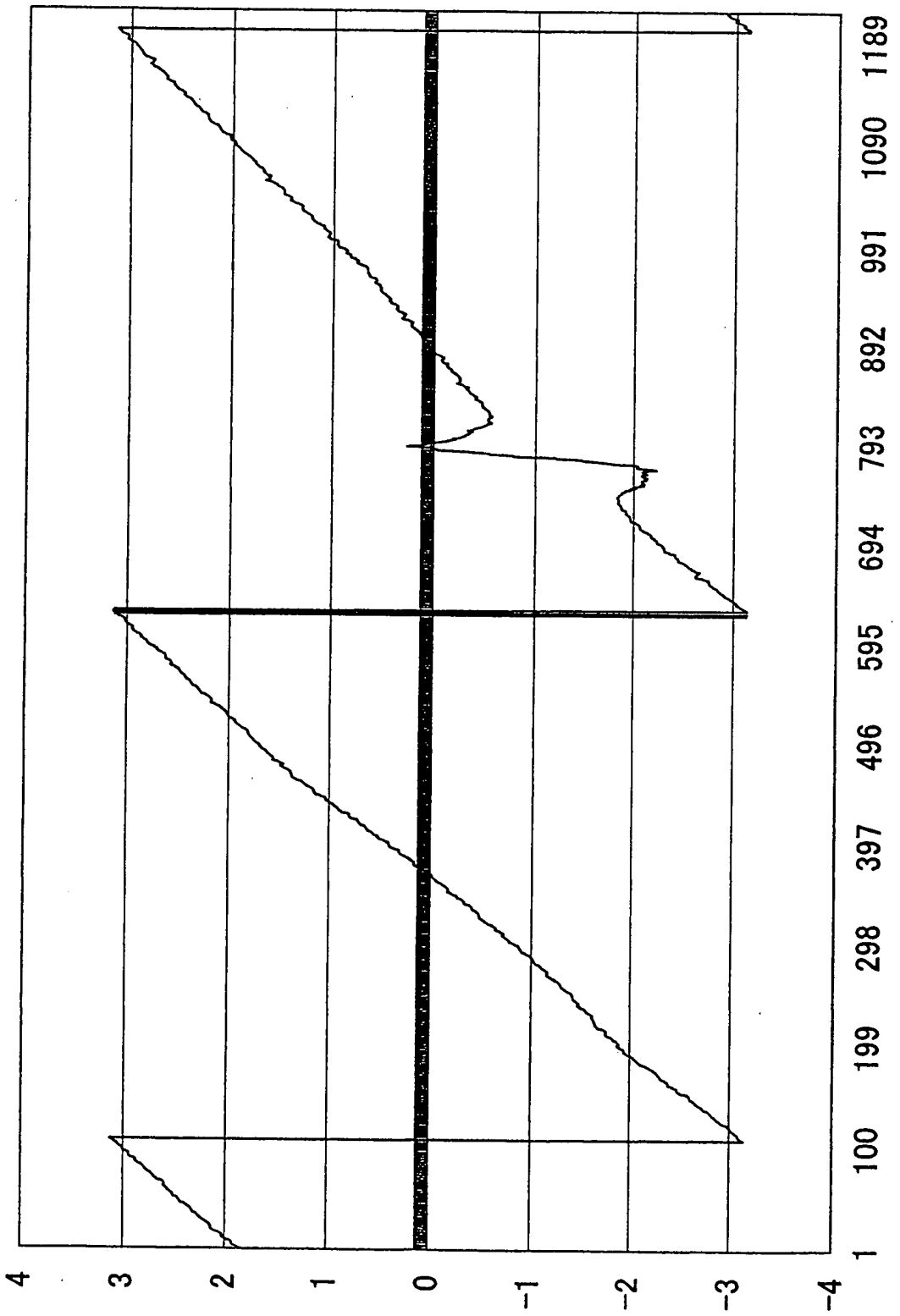


FIG. 23

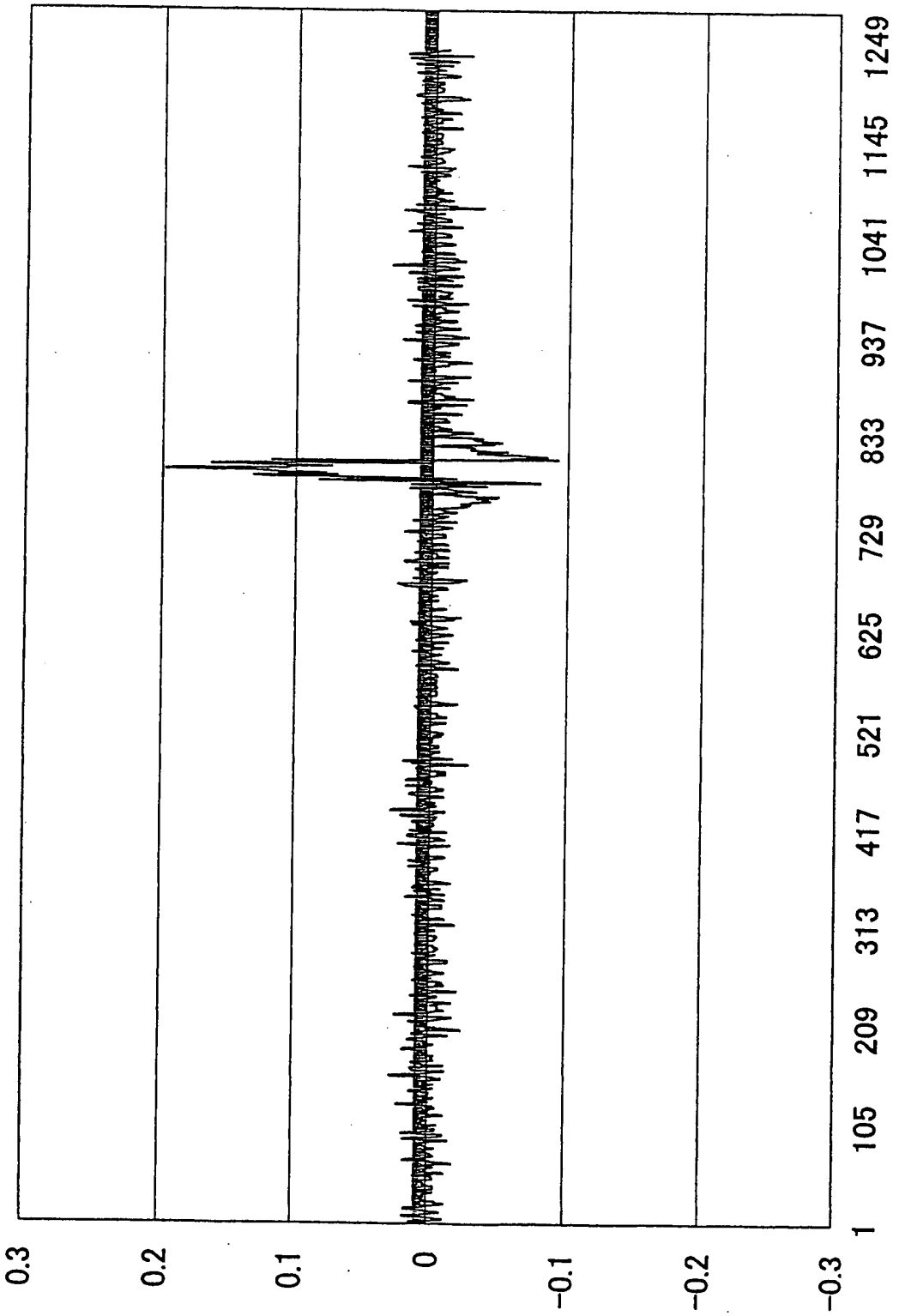

0.3
0.2
0.1
0
−0.1
−0.2
−0.3
1
105
209
313
417
521
625
729
833
937
1041
1145
1249

FIG. 24

FLOWCHART OF SOFTWARE PROCESSING
(PHASE A, PHASE B, PHASE C, PHASE D)

h : NUMBER OF PIXELS PER PITCH
fugo : SIGN FOR CALCULATING ORIGINAL IMAGE DATA
shift : AMOUNT OF SHIFT FOR CALCULATION FOR GENERATING SINE WAVES SHIFTED AT 90°
data : ORIGINAL IMAGE DATA
phase_a : DATA ON SINE WAVES WITH PHASE A
phase_b : DATA ON SINE WAVES WITH PHASE B
phase_c : DATA ON SINE WAVES WITH PHASE C
phase_d : DATA ON SINE WAVES WITH PHASE D
ccc : PHASE ANGLE ON FIGURE
ddd : ANGULAR SPEED
pixel : NUMBER OF PIXELS FOR PROCESSING

STEP 1
GENERATE SIGN
GENERATE +-+-+-+-

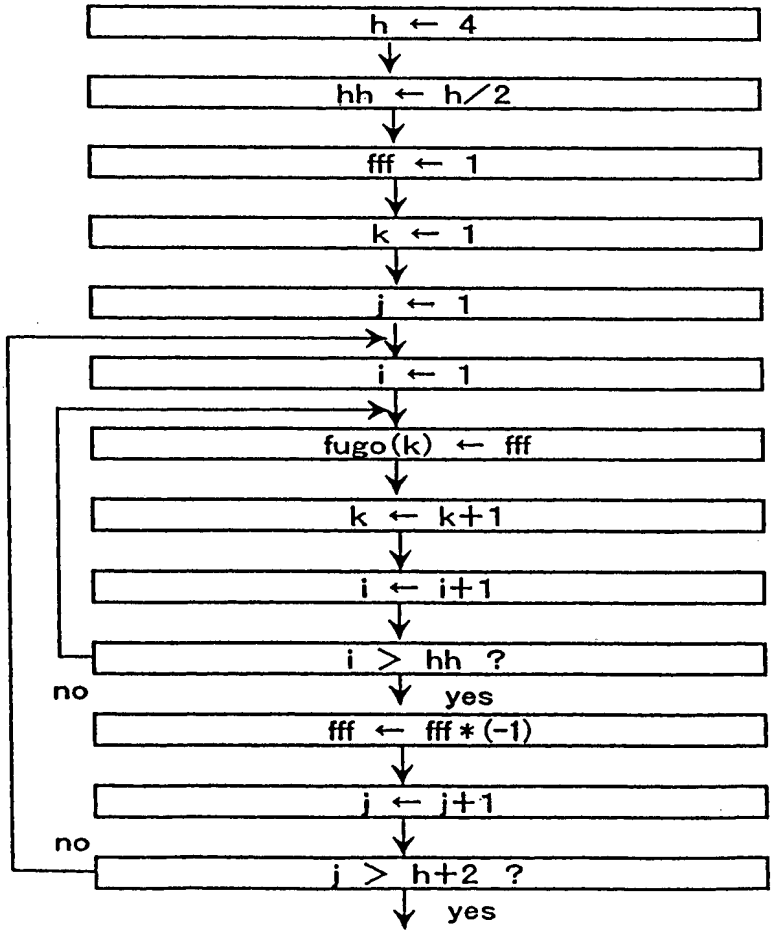


FIG. 25

STEP 2 GENERATE SINE WAVES WITH PHASE A, PHASE B, PHASE C, AND PHASE D

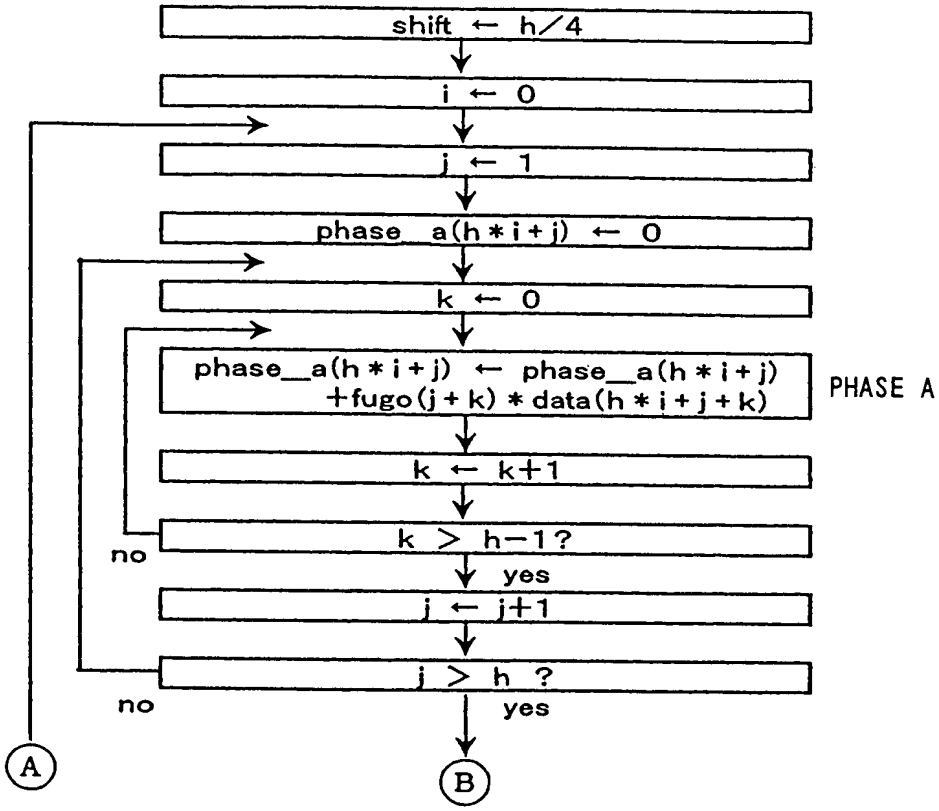


FIG. 26

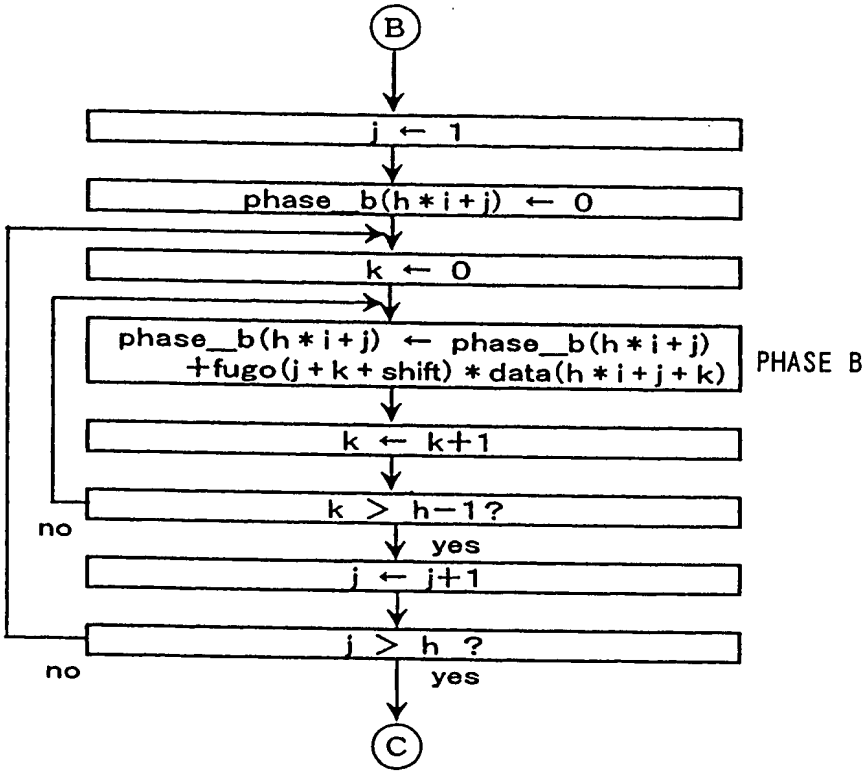

B
j ← 1
phase_b(h*i+j) ← 0
k ← 0
phase_b(h*i+j) ← phase_b(h*i+j)
+fugo(j+k+shift)*data(h*i+j+k)
PHASE B
k ← k+1
k > h−1?
no
yes
j ← j+1
j > h ?
no
yes
C

FIG. 27

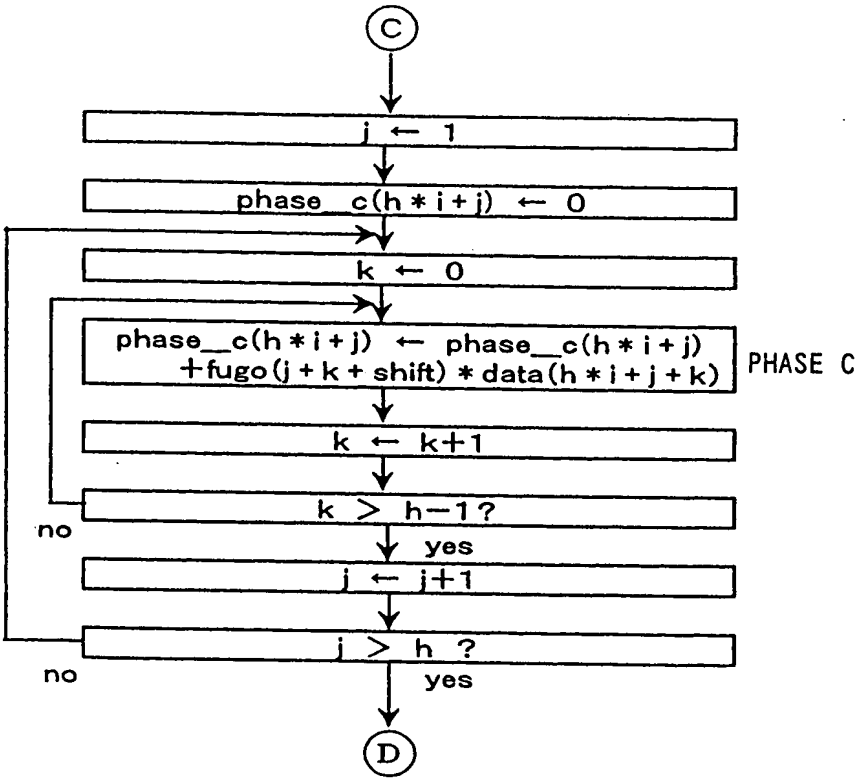

C
j ← 1
phase_c(h*i+j) ← 0
k ← 0
phase_c(h*i+j) ← phase_c(h*i+j)
+fugo(j+k+shift)*data(h*i+j+k)
PHASE C
k ← k+1
k > h−1?
no
yes
j ← j+1
j > h ?
no
yes
D

FIG. 28

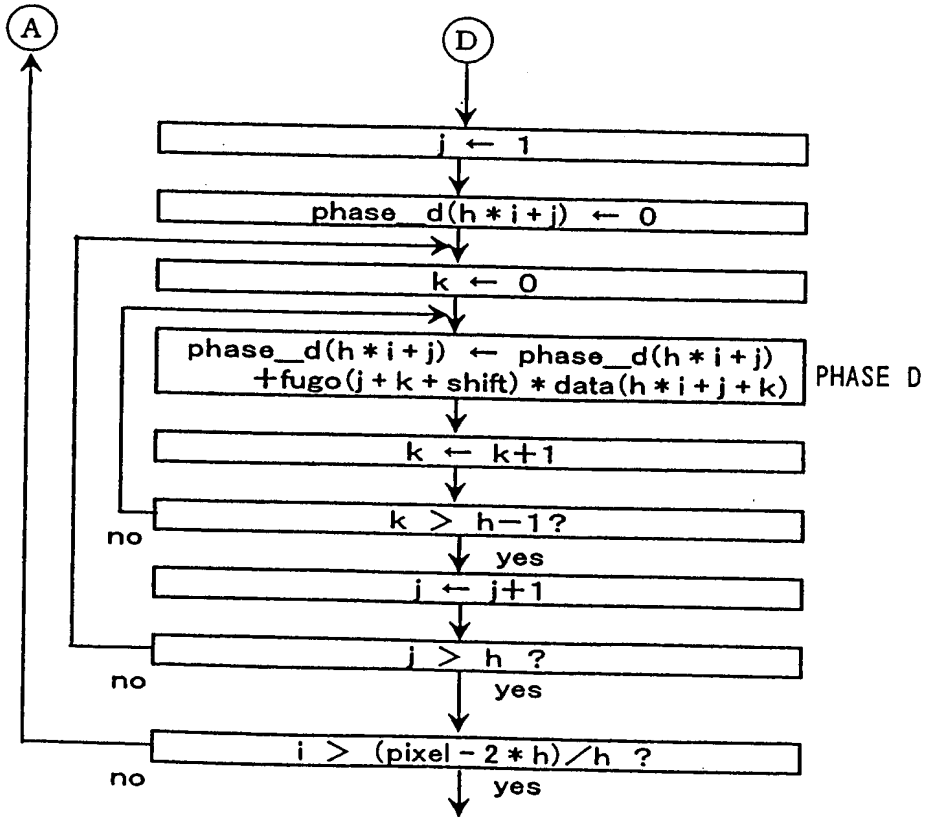

A
D
j ← 1
phase_d(h * i + j) ← 0
k ← 0
phase_d(h * i + j) ← phase_d(h * i + j)
+fugo(j + k + shift) * data(h * i + j + k)
PHASE D
k ← k+1
k > h−1?
no
yes
j ← j+1
j > h ?
no
yes
i > (pixel − 2 * h)/h ?
no
yes

FIG. 29

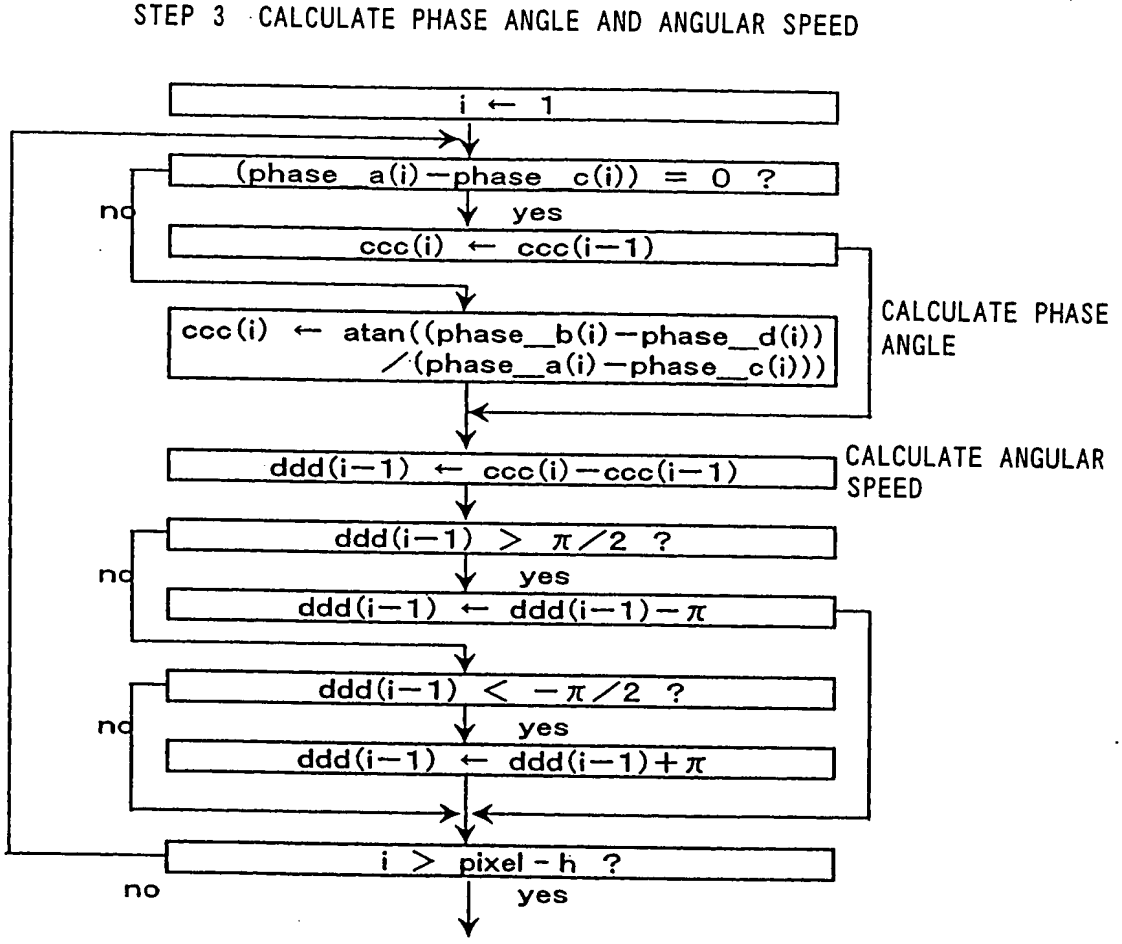
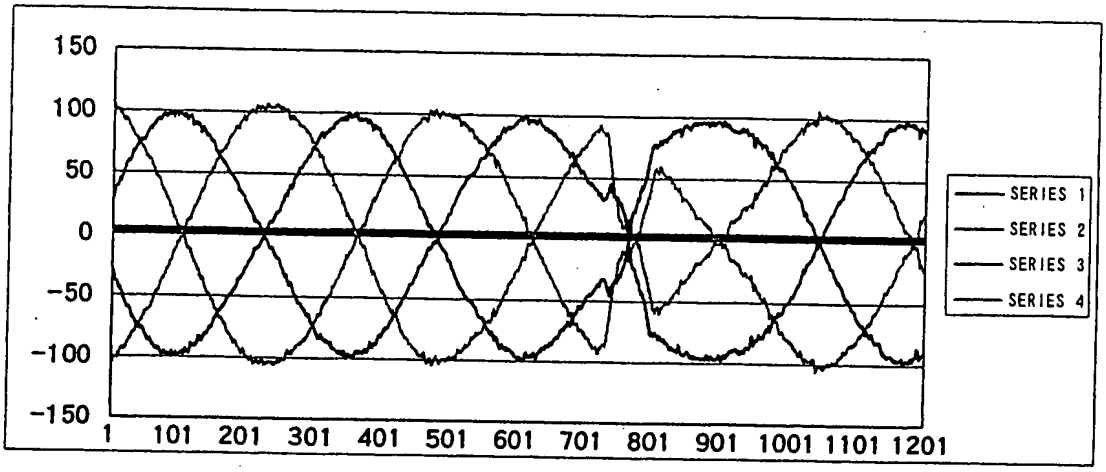

STEP 3 CALCULATE PHASE ANGLE AND ANGULAR SPEED
i ← 1
(phase_a(i)−phase_c(i)) = 0 ?
no
yes
ccc(i) ← ccc(i−1)
ccc(i) ← atan((phase_b(i)−phase_d(i))/(phase_a(i)−phase_c(i)))
CALCULATE PHASE ANGLE
ddd(i−1) ← ccc(i)−ccc(i−1)
CALCULATE ANGULAR SPEED
ddd(i−1) > π/2 ?
no
yes
ddd(i−1) ← ddd(i−1)−π
ddd(i−1) < −π/2 ?
no
yes
ddd(i−1) ← ddd(i−1)+π
i > pixel-h ?
no
yes

FIG. 30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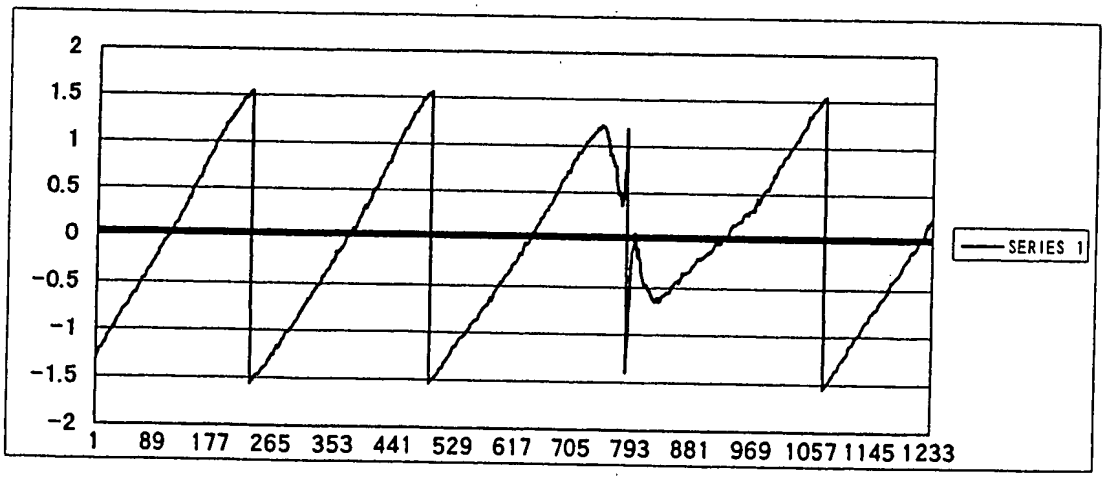
-100
-150
1
101
201
301
401
501
601
701
801
901
1001
1101
1201
SERIES 1
SERIES 2
SERIES 3
SERIES 4

FIG. 31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1
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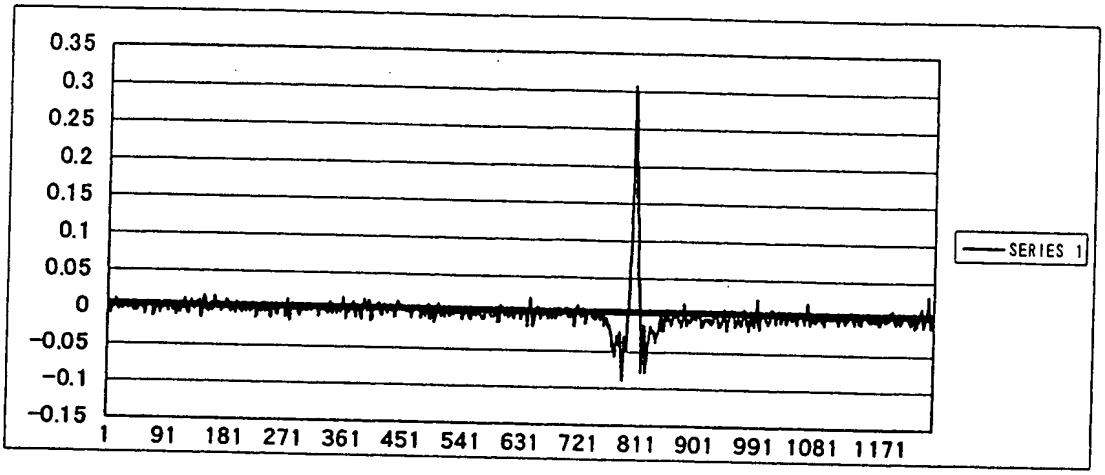
0
-0.5
-1
-1.5
-2
1
89
177
265
353
441
529
617
705
793
881
969
1057
1145
1233
SERIES 1

FIG. 32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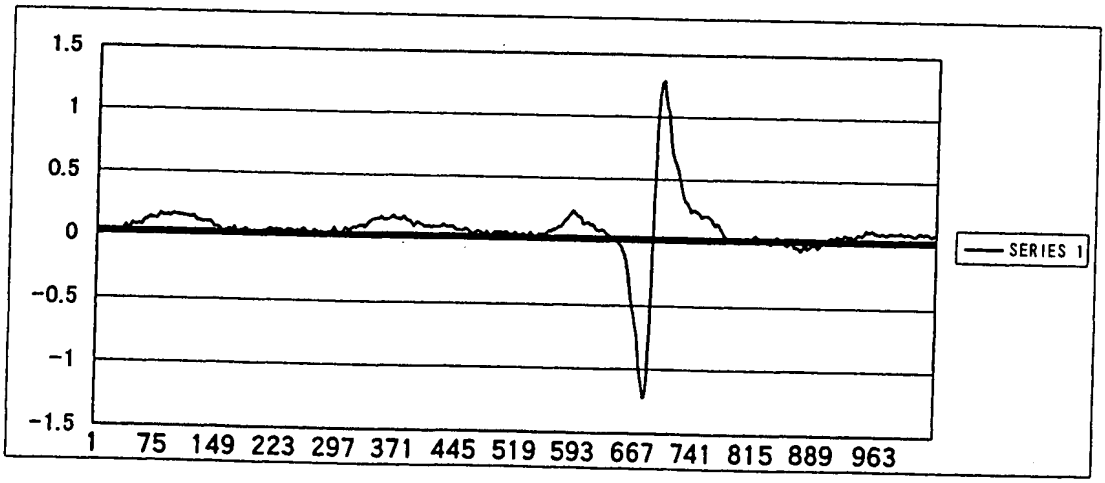
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
1
91
181
271
361
451
541
631
721
811
901
991
1081
1171
SERIES 1

FIG. 33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-1
-1.5
1
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223
297
371
445
519
593
667
741
815
889
963
SERIES 1

FIG. 34

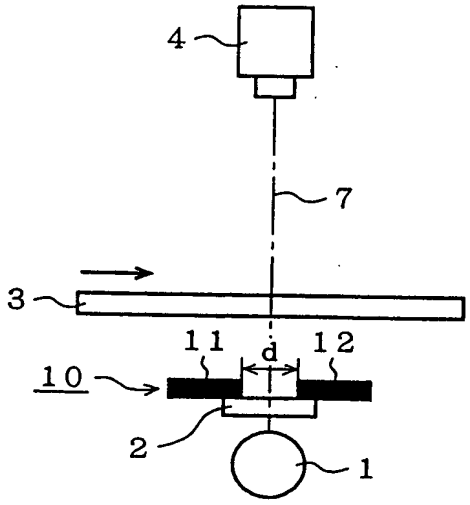

FIG. 35

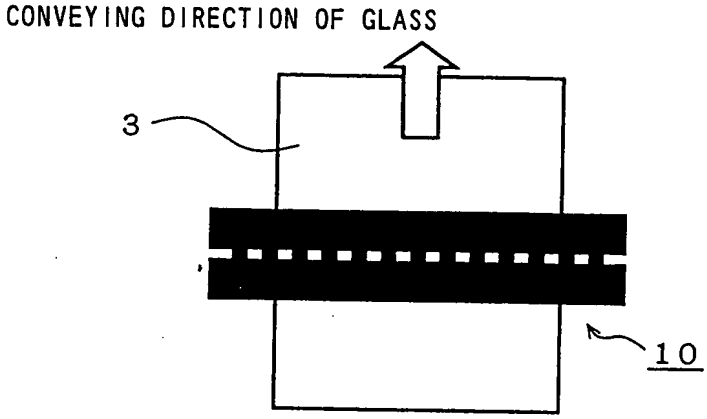

FIG. 36

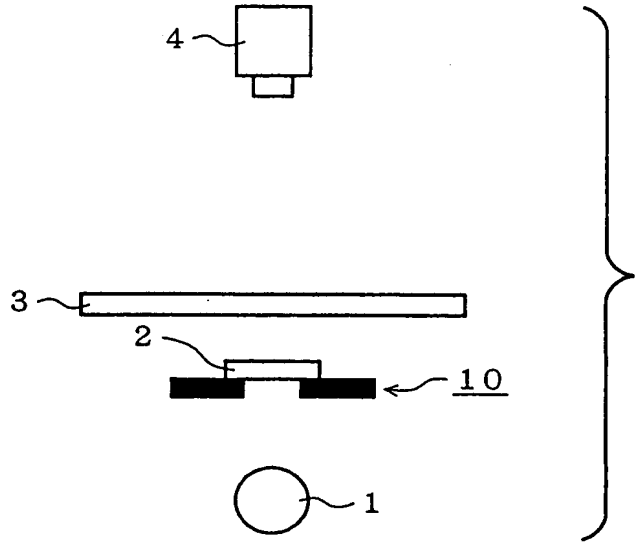

FIG. 37A

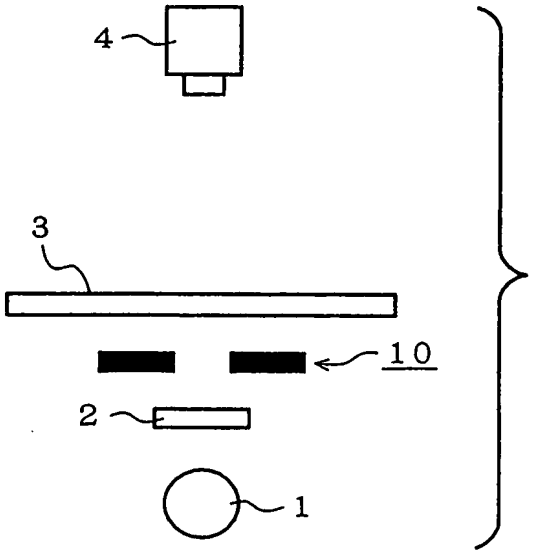

FIG. 37B

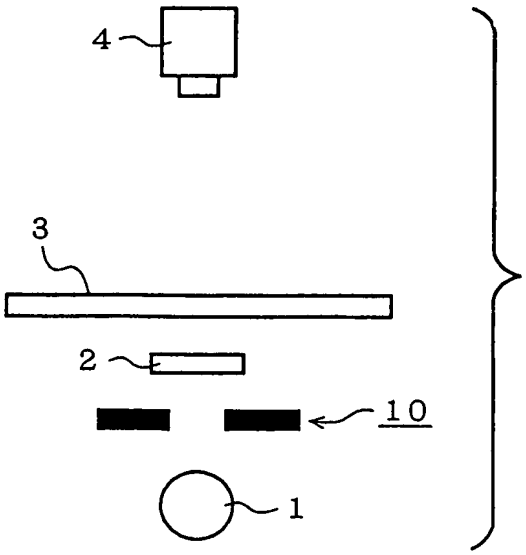

FIG. 38

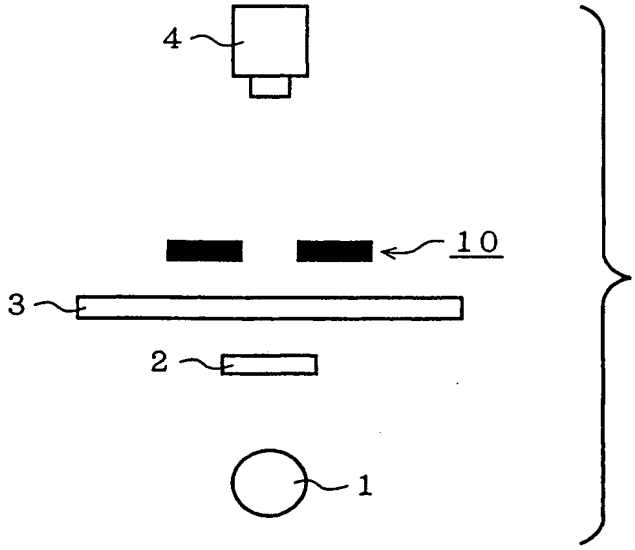
4
10
3
2
1

FIG. 39

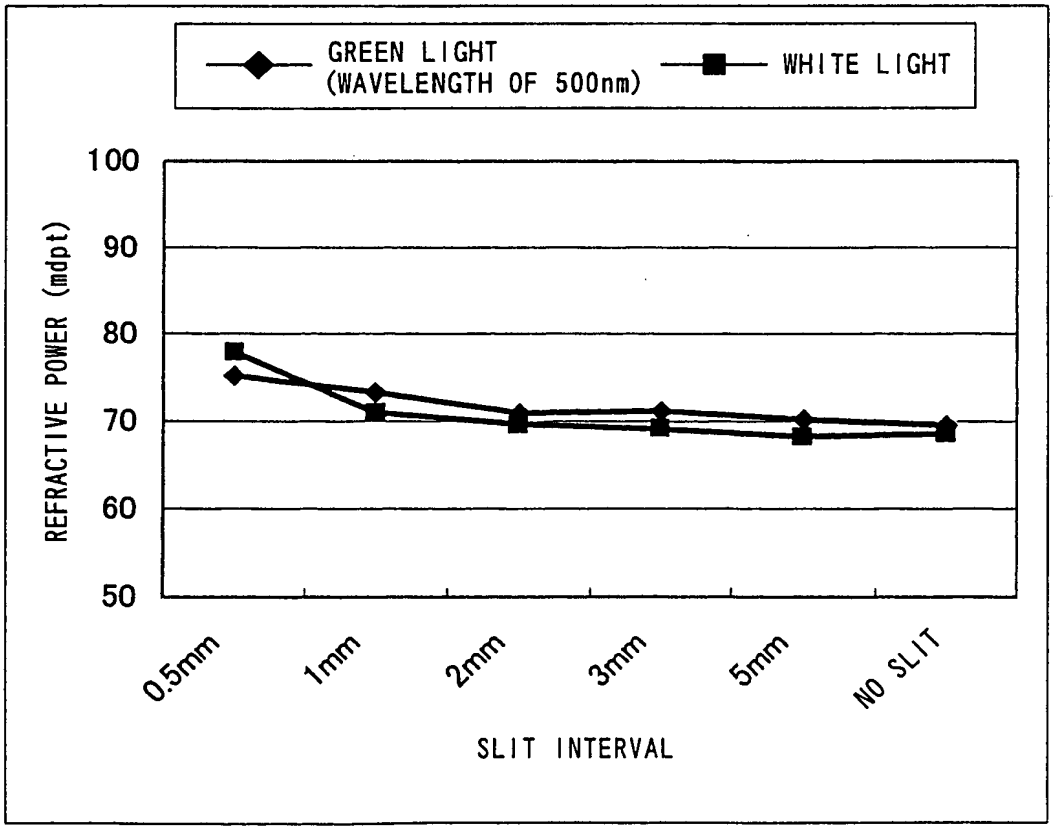
GREEN LIGHT
(WAVELENGTH OF 500nm)
WHITE LIGHT
100
90
80
70
60
50
REFRACTIVE POWER (mdpt)
0.5mm
1mm
2mm
3mm
5mm
NO SLIT
SLIT INTERVAL

FIG. 40

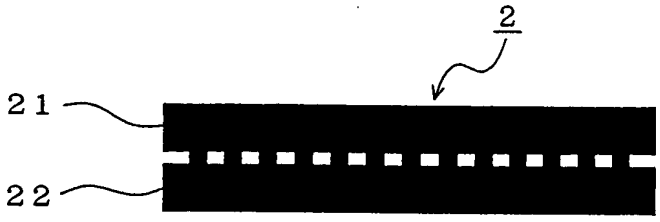

FIG. 41

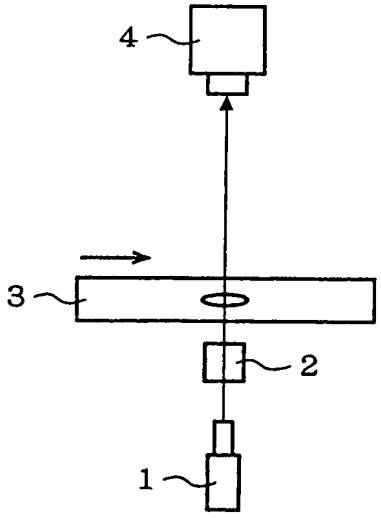

FIG. 42